Liang et al., Afr J Tradit Complement Altern Med. (2016) 13(5):33-37
doi:10.21010/ajtcam.v13i5.5

AN EXPERIMENTAL STUDY ON BIASED COGNITIVE PROCESSING IN ACCIDENTALLY INJURED PATIENTS WITH DIFFERENT POSTTRAUMATIC GROWTH LEVELS

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Abstract

Background: Various studies have assessed the negative and/or positive changes in the aftermath of traumatic events. Accidental injuries (such as accidents, injuries, etc.), for its high incidence and disability rate, is easy to cause serious psychological problems and hinder the physical and psychological rehabilitation of the patients.

Material and Methods: To explore the characteristics of attention bias in accidentally injured patients with different levels of Posttraumatic growth (PTG), total score of PTG was adopted to screen out 15 high-PTG group and low-PTG group respectively among accidentally injured patients. Dot probe task was used with positive, negative and neutral facial expression pictures as experimental materials. An experimental design of 2 (facial expression: positive and negative)×2 (consistency of probe point and facial expression: consistent and inconsistent)×2 (PTG level: high and low) was employed.

Results: Patients with low PTG level had attention bias toward the negative emotional stimuli, and difficulty in distraction from the negative emotional pictures. The value of D and DI were both significantly greater than 0 ($p<0.05$). Patients with high PTG level did not demonstrate significant attention bias toward positive or negative emotional stimuli. The responding time of patients with high PTG level was significantly shorter than that in patients with low PTG level in the incongruent task ($p<0.05$).

Conclusion: There are different characteristics of implicit cognitive processing in patients with different level of PTG, suggesting the necessity of psychological intervention on the accidentally injured patients.

Key words: Accidentally injured patients; Posttraumatic growth; Attention bias; Dot probe task

Introduction

Posttraumatic stress disorder (PTSD) is a clinical syndrome that develops after experiencing or witnessing traumatic events. Several researchers have concluded that severely injured patients, such as patients with multiple trauma (MT) and spinal cord injuries (SCI), are at greater risk of developing posttraumatic stress disorder (PTSD) (Richter et al, 2006; Starr et al, 2004). The prevalence of PTSD symptoms after sustaining a physical injury varies between 1% and 46% in populations of multi-traumatized or other severely injured patients (Blanchard et al, 1995; Malt 1988; Mayou & Bryant, 2002), and 10% and 40% in SCI populations (Kennedy & Duff, 2001). Recent studies have found that subsyndromal PTSD, also called partial PTSD or subthreshold PTSD, is about as common as full PTSD and is associated with substantial problems in social and occupational functioning, comorbid major depressive disorder, as well as a relatively high number of suicide attempts (Zlotnick et al, 2002). Post-traumatic growth (PTG) may entail enhanced interpersonal relationships, new possibilities, increased personal strength, spiritual changes and greater appreciation of life (Calhoun & Tedeschi, 2004). A positive relationship has been identified between cognitive processing and PTG (Linley, 2004). Patients with higher PTGI scores show consistently lower level of depressive and anxious symptoms in comparison to patients with lower PTGI score (Tedeschi & Calhoun, 2004).

Study find that individuals of high PTSD show the attention alert and attention to the lifting of the difficulties to attention bias

of negative emotional information. At present, there isn't still a study to explore the characteristics of individual attention bias in different PTG levels. Or it can help to better understand the cognitive processing mechanism of PTG. It can also provide a new idea for the cognitive intervention of accident trauma patients.

Materials and Methods

Subjects

Majority of the subjects were recruited from patients with accidental trauma in a rehabilitation hospital in Nanjing city, China. Recruition criteria: 1. Patients admitted to hospital and accompanied by dysfunction for some incidents (traffic accident, work-related injury etc). 2. Age: 18-65 years old. 3. Normal or corrected-to-normal vision. 3. Right hand with normal function, including operating the mouse. Exclusion criteria: 1. Functional and organic mental disorders. 2. Brain injury. 3. Cognitive impairment. 4. Failure to complete the questionnaire. Posttraumatic growth rating scale (simplified Chinese version) (C-PTGI) was taken []. There were 20 items. Likert 6 grade score from insensitivity to sensitivity to the changes after trauma, in order score as 0-5. The total score are 0-100. The higher score indicates higher the level of trauma. The norm for the accidental trauma is 58.14±15.30. Sixty valid questionnaires were sorted from high to low according to PTG total scores. Fifteen participates were screened for follow-up experiments according to high and low two grade sections. Basic information of two groups of subjects was shown in table 1. *t* test shows insignificant difference in age and sex between two experiment groups ($p>0.05$). Two sets PTG score difference was significant ($p<0.05$). t (28)=-8.60, $p<0.001$. And the score of high PTG group was significantly higher than that of the norm. t (641)=2.00, $p<0.05$. And the score of low PTG group was significantly lower than that of the norm. (641)=-5.20, $p<0.001$.

Table 1: Basic information of subjects

Group	Sex (male/female)	Age	PTG
High PTG	15/0	34.33±10.72	66.07±8.12
Low PTG	13/2	32.87±12.92	37.47±10.0

Experimental Materials

In this experiment, the picture stimulus material is selected from Chinese emotional face image system compiled by of Luo Yuejia et al. 120 mood expression pictures were selected from the pictures library. Negative emotional expression pictures were 120. Pleasure degree was 2.71±0.46. Neutral emotional expression pictures were 80. Pleasure degree was 4.34±0.61. The positive mood pictures were 20. Pleasure degree was 7.41 ±0.53. 20 combinations of positive and neutral emotional expressions were paired. 20 combinations of negative and neutral emotional expressions were paired. 20 combinations of neutral and neutral emotional expressions were paired. Size of mood expression image uniformly was 7.5cm * 8.5cm. Colour was black-white. In addition, 10 pairs of mood expression pictures were selected as exercise material from the pictures library.

Experimental Design and Procedures

Point probe task was used to perform 2 (expression to nature: positivity, negativity)×2 (The consistency of detection point and expression image: consistency, inconsistency) ×2 (high PTG, low PTG) composite design. Among them, combination of neutral and neutral emotional expressions was used as control material.

After the experiment began, a black "+" appearing in the middle of the screen was taken as fixation point. After 500ms, the fixation point disappeared; and then two mood expression pictures simultaneously appeared in symmetric position on the left and right on the screen central. After 500ms, the fixation point disappeared; and then one "*" probe point will appear behind one picture of them. Subjects were requested to respond to the location of the probe point as soon as possible. When detection point was in the

left side of the screen, the left mouse button was clicked. When detection point was in the right side of the screen, the right mouse button was clicked. If subject responds by clicking mouse, the probe point will disappear and enter the next judgment task at a random time interval (500ms-1500ms); if subject didn't respond within 5s, the probe point will disappear and enter the next judgment task. Experiment material procedure was compiled by E-prime 1 Software. Pictures of different expressions appear on the left and right side of the screen with equal probability. Detection point appears in the same or different side of emotional pictures with equal probability. After subjects completed 10 exercise pictures, formal experiment began.

Data Processing and Statistical Methods

In test, the reaction time lower than 200ms or higher than 1250ms won't be included in data analysis. Subjects show wrong response, or respond time exceeds three standard deviation of the subject's mean respond time. These won't also be included in data analysis. In this study, the accuracy rate of the two groups didn't show statistically significant difference (p>0.05). Considering accuracy and reaction time on the significance of the study, in this study, the response was selected as the only dependent variable. The accuracy rate won't be considered for analysis. IBM SPSS statistics software (19.0) was used for t test and variance analysis of repeated measurement data.

Results

Comparison of Response Time of Subjects with Different PTG Level to Emotional Expression Pictures

Mean and standard deviation of response time of two groups of subjects to different facial expressions were shown in Table 2. The results of analysis of variance of repeated measurement data showed as followings:

Main effects of PTG Level, the emotional nature of the picture, the position of the detection point to the response time were not significant. (F(1, 28)=2.92, p=0.10; F(1, 28)=2.69, p=0.11; F(1, 28)=0.00, p=0.99); There existed significant interaction effect among PTG Level, the emotional nature of the picture, the position of the detection point. F(1, 28)=11.03, p<0.01. It suggested that there was a significant difference in response time to different emotional expressions pictures of different positions between the two groups of subjects with high and low levels of PTG. Independent sample t test display, When the image of the negative emotion expression is not consistent with the position of the detecting point (the detection point appears in the position of the neutral emotion expression image), response time of group with high PTG level (460.17±80.92ms) is significantly less than group with low PTG level (555.89±135.50ms). The difference was statistically significant (t(28)=2.35, p=0.026).

Table 2: Response time of subjects of two groups to different emotional expression pictures (ms)

Group	Pair of Negative-neutral emotional expressions		Pair of positive-neutral emotional expressions	
	negative emotional expressions	neutral emotional expressions	Positive emotional expressions	neutral emotional expressions
High PTG	462.13±115.42	460.17±80.92	482.08±127.34	467.01±110.14
Low PTG	541.10±124.32	555.89±135.50	545.26±149.58	549.50±143.87

Comparison of Attentional Bias of Subjects with Different PTG Level to Emotional Expression Pictures

Positive values indicate that subjects have attention bias to emotional expression pictures. Negative values indicate that subjects have avoidance phenomena to emotional expression pictures. Attention bias of subjects of two groups was compared with 0 (indicating no attention bias). Single sample t test was performed. Results were shown in Table 3. Attentional bias of the group of low PTG level to negative emotional expression pictures displays significant difference (t(28)=2.19, p=0.046). Attentional bias of the

group of high PTG level to negative emotional expression pictures displays insignificant difference (p<0.05).

Table 3: Attentional bias of subjects of two groups (ms)

Group	Negative attentional bias	Positive attentional bias
High PTG	-1.95±69.73	-15.07±43.03
Low PTG	30.69±54.07*	4.24±63.85

*p<0.05, compared with High PTG group

Comparison of Orienting and Disengaging Index of Subjects with Different PTG Level to Emotional Expression Pictures

OI and DI of subjects of two groups were compared with 0. Single sample t test was performed. Results were shown in Table 4. t test shows as followings: DI of subjects of low PTG level to negative emotional expressions pictures was significantly bigger than 0, t(14)=2.31, p=0.037. That is, there exists a difficulty in disengaging in subjects of the group of low PTG level from negative emotional expression pictures.

Table 4: Response time of subjects of two groups to different emotional expression pictures (ms)

Group	OI		DI	
	Negativity	Positivity	negativity	positivity
High PTG	-1.93±68.69	-21.88±53.08	-0.03±39.96	6.81±38.17
Low PTG	-1.68±58.59	-5.84±59.34	25.48±42.78*	10.08±53.39

*p<0.05, compared with High PTG group

Discussion

The current study finds that the results that subjects with low PTG display “negative attentional bias” and “difficulty in disengaging from negative emotional expression pictures” confirm the illustration of mood congruent theory about “information consistent with the current mood is more likely to get cognitive processing” (Nixon et al, 2013). That is, for the subjects with low PTG level, under the influence of the emotional pain after the accidental trauma, they will perform the cognitive processing to the pictures consistent with current emotional expression by mobilizing more attention resources, and show a preference for pictures of negative emotional expressions. The preferential attention to negative emotion information can restrain the self-regulating process of subjects, and affect their positive psychological adjustment after the trauma (Fox et al, 2009). This study found, once subjects with low PTG level easily immersed in negative emotions, it's hard to break away from the emotional pain. To a certain extent, this inhibits subjects’ active cognitive processing to traumatic events, and makes it difficult to explore the positive significance of trauma events, and then hinders their positive growth. The results support some scholars’ viewpoints, That is, attentional bias to negative emotions is an important cognitive mechanism in the formation of individual PTG. Individual attentional bias may affect the role of its explicit cognitive processing in PTG. In this study, we did not find that the subjects with high PTG level showed a significant attention bias to or difficulties in disengaging from the attention to negative emotional expression pictures. In contrast, the subjects with high PTG showed a attention bias to neutral emotional expressions pictures. Especially when the picture of the negative emotion expression is not consistent with the position of the detection point, response speed of subjects with high PTG level to the neutral emotion expression pictures are faster than that of subjects with low PTG level. This further suggests that subjects with high PTG levels are less affected by negative emotional stimuli. They have been able to effectively manage the emotional pain after trauma. In addition, subjects of high PTG levels didn’t also show attentional bias towards positive emotional stimuli. From another point of view, this result confirms that PTG is the real change of the subjects after the accident trauma, rather than a positive fantasy to trauma (Janoff- Bulman, 1992; 2004). In this study, subjects of high PTG levels neither showed the cognitive bias toward positive or negative information, nor confined to the negative information so as to difficultly extricate themselves. It shows that they have a

strong cognitive flexibility and cognitive span. Therefore, they can effectively process the trauma information to promote their own growth after accidental trauma. But in view of the small sample size of this study, the reliability and stability of the research conclusions are limited. Further large sample demonstration is to be carried out in the future. From the above results, it can be found that there are differences in cognitive processing characteristics of the injured at different levels of development. Distinguishing cognitive bias of the subjects of different PTG levels may provide a new idea for the evaluation and intervention of clinical PTG. This suggests that the researchers may try to assess their cognitive processing and predict the level of post traumatic growth by examining the attention bias of the injured. For example, by assessing the changes in the attention of the injured before and after the intervention (negative attention bias reduced, difficulty in disengaging from attention disappeared, etc.), we may objectively evaluate the effect of psychological intervention on the cognitive processing of the injured. In view of the fact that attentional bias can affect the level of PTG, psychological intervention on patients with accidental trauma can be introduced to change or train the attention bias way of the subjects to promote their PTG. How to utilize the generally recognized research conclusions (individuals in the mood state of pleasure can show attention bias to the positive emotional information (Iverson et al, 2015)), may create a pleasant psychological intervention for the injured, guide their attention bias to positive or neutral emotional information so as to reduce the negative impact on the psychological adjustment, and then promote their PTG.

Acknowledgement

This study is supported by Natural Science Foundation of Zhejiang province (LY13G030020).

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